

Taking silk screen to the **second dimension**

Architects using the application on two surfaces of an IG unit

By Alissa Schmidt

Populous, a global design firm headquartered in Kansas City, Mo., is known around the world for designing environments that provide people with unforgettable experiences. From the new Yankee Stadium to Berlin's O2 World Arena, the firm is known for its bold, innovative style. So, when it came time to build its own headquarters, the Populous design team was aiming for anything but ordinary. To enhance energy performance while adding an eye-catching aesthetic to the building's glass skin, designers opted for silk-screen patterns on two surfaces of the insulating glass configuration, for a different twist.

The most common silk-screen applications have the design applied to one surface of an insulating unit. In recent years, in response to changing design aesthetics, architects have begun exploring the use of placing silk-screen patterns on two surfaces. While this does provide additional design options, using patterns on multiple surfaces also has aesthetic challenges.

Traditional placement of silk-screen pattern

An insulating glass unit has two plies of glass, for a total of

four surfaces (see Fig. 1). The silk-screen pattern is typically placed on the second surface along with the low-E coating. The silk-screen pattern is applied first, and the low-E coating is applied over the silk-screen pattern. This combination offers optimal performance, by placing both the silk screen and the coating on the surface closest to the sun. While it is possible to place the silk-screen pattern on the third surface with a low-E coating on the second surface, this configuration will block less heat than placing the coating and the silk-screen pattern on the second surface. (see Fig. 2).

As silk-screen patterns have increased in popularity as a means of solar control, their use as a design element also has increased. As architects seek ways to push design to the next level, playing with the silk-screen pattern has become increasingly frequent. When deciding whether to place the pattern on the second or third surface, it is becoming typical for the debate to move to: "why not both?"

Dual surface design misconceptions

Placing a pattern on the second and third surfaces can sound like an appealing means of enhancing aesthetics. Designers

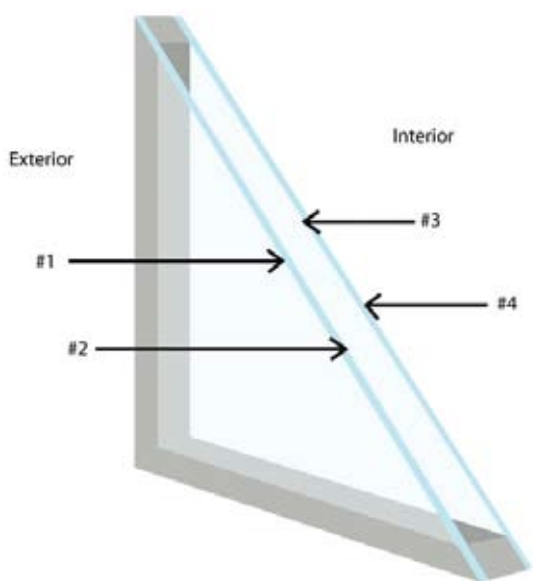


Fig. 1

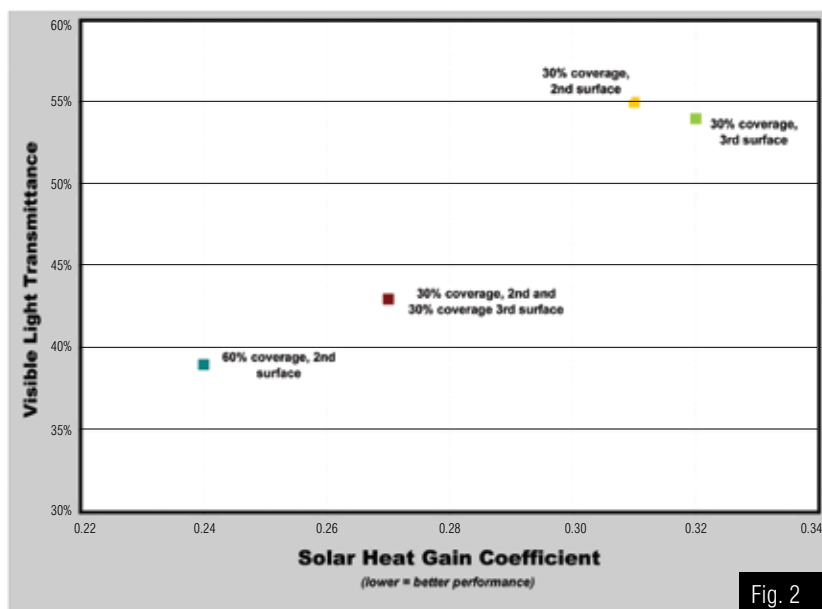
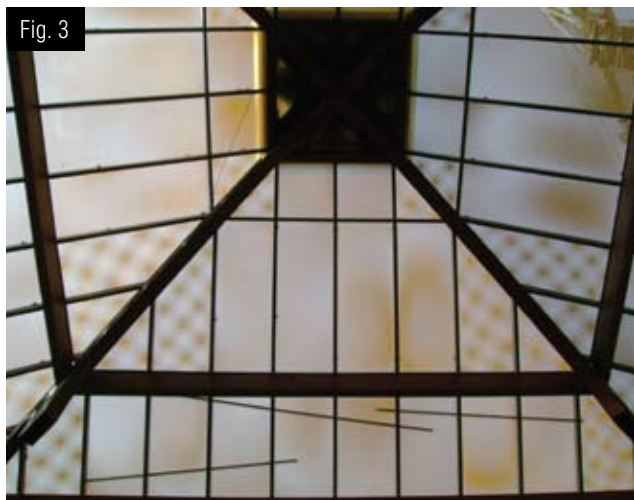


Fig. 2

Note: Performance is based on 1 inch VE1-2M, low-E coated insulating units with white ceramic frit



often envision adding “depth” to a building’s surface by playing with patterns on two separate planes in the glazing unit. As with any design element, if used properly, dual design patterns can enhance overall building aesthetics. However, when used improperly, dual surface designs can significantly decrease the visual appeal of a façade.

For example, when a silk screen pattern is applied to glass, there is a potential to see a moiré pattern. This is an optical phenomenon that appears as a wavy, rippled or circular pattern. It is not a defect in the glass or the silk screening, but rather an image formed by the eye; it may appear or disappear as lighting conditions change. A moiré pattern is produced when two regularly spaced patterns, one in front of the other, are slightly offset from each other, creating interference.

Moiré patterns may appear in a variety of designs; however, there are specific design configurations that are known to increase the potential of seeing a moiré pattern. Two patterns that line up with each other are almost always guaranteed to create a moiré pattern. For example, placing 1/8-inch dots on the second surface and 1/8-inch holes on the third surface will cause moiré patterns. The chance of seeing a moiré pattern also increases when the same color of ceramic frit is used for both patterns, when closely spaced patterns are used or when a high light transmitting glass and coating are used.

As evidenced in Fig. 3, moiré patterns are not consistent, and the appearance of the pattern will change under varying light conditions. To avoid potential problems, it is critical to carefully review the patterns and colors selected, and the location of the patterns on the glass unit. Because the patterns may appear under some lighting conditions and not others, it is extremely important to view a mock-up of any dual surface pattern, preferably on-site under the same lighting conditions as the completed project.

Using a silk-screen pattern on two surfaces does not, however, need to be avoided at all costs. There are cases where this has been done with a striking outcome.

The Populous headquarters building in Kansas City utilizes

Why use a silk-screen pattern?

Solar control

The majority of commercial glazing today is an insulating unit with a low-emissivity coating on the second surface. As building codes continue to require higher levels of energy control, a low-E coating alone is not always enough. Adding a silk-screen pattern can help achieve the next level of performance by blocking more heat than the coating alone.

Glare reduction

Glare is any type of light that interferes with visual perception. It can be direct, such as from the sun, or reflected from surfaces such as computer screens. Exterior glazing controls the light coming into a space and therefore is a component in glare control. High light transmitting glass is often specified to provide a view into a building from the exterior. While this can enhance the exterior façade, it can cause glare concerns for the interior building occupants. Whenever glazing allows 50 percent or more of the visible portion of the spectrum into a building, the potential for glare is increased. Adding a silk-screen pattern reduces visible light transmittance, reducing glare potential.

Aesthetics

In some cases, silk-screen patterns are added for purely aesthetic reasons. The aesthetic options to be explored with silk-screening are nearly endless. Patterns can be customized using anything from repetitive patterns over an entire piece of glass to a single element on just a portion of the glass. Colors can also be looked at with most glass fabricators offering standard and custom ceramic frit colors.



The Populous headquarters in Kansas City, Mo., features square doughnuts in two different colors on the second and third surfaces.

floor to ceiling glazing with a pattern at the top and bottom of each piece of glass. The pattern utilizes “square doughnuts” on the second and third surface in random placement. Two different translucent ceramic frit colors also were used.

Another project that utilized a dual surface silk-screen pattern is the Hamilton Farmer's Market Renovation in Hamilton, Ontario. A white line pattern was used on both the second and third surface. The lines varied in thickness from $\frac{1}{4}$ inch up to $\frac{3}{4}$ inch. In addition, the spacing was varied to create a random pattern across the façade.

One of the keys to these projects—and to most successful dual surface silk-screen projects—is the random pattern. When designing with dual patterns, random is better than repetitive. If designers are thinking about how

the design is going to “line up” between the two panes, it is likely not the right design to be using on two surfaces. The silk-screen manufacturing process does not allow for exact alignment. If the pattern is off even $\frac{1}{32}$ inch it will no longer line up, the intended appearance will not be achieved and the potential to see a moiré pattern will be significant.

The bottom line

Even with high-performance coatings, the transparent appearance preferred by architects today often does not meet performance required by codes or requested by building owners. The addition of a silk-screen pattern has become a common method to significantly improve performance while adding interesting aesthetics. Many architects want to take silk-screening to the next level by using the patterns on two surfaces of a glass configuration. While this concept provides a multitude of additional design options, caution must be exercised to make sure the design does not cause unintended visual shortcomings. **■**

The author is an architectural design associate, Viracon, Owatonna, Minn. Write her at aschmidt@viracon.com.



Photo credit: Ferguson-Neudorf Glass, Inc.

The Hamilton Farmer's Market, Hamilton, Ontario, incorporates white lines in varying thicknesses on the second and third surfaces.